

THE GENUS *ARISTAENETUS* DISTANT (HEMIPTERA: LYGAEIDAE:
RHYPAROCHROMINAE) WITH THE DESCRIPTION OF A NEW SPECIES

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The endemic Australian genus *Aristaenetus* (Lethaeini) and its type species *A. diffinis* (Walker) are redescribed. *A. similis* sp. nov. and its nymphs are described. Sexual dimorphism of the metapleural scent gland peritreme and variation in the structure of the female peritreme of both species are described and figured.

□ Hemiptera, Lygaeidae, *Aristaenetus*, taxonomy, scent gland dimorphism.

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Aristaenetus Distant is an endemic Australian genus belonging to the tribe Lethaeini Stål as redefined by Ashlock (1964) and as keyed out by Sweet (1967). The type species, *A. diffinis* (Walker), was described from Moreton Bay, south-east Queensland; its known distribution is now extended to north-east Queensland. *A. similis* sp. nov. is recorded from north-east Queensland to eastern New South Wales.

Abbreviations: ANIC Australian National Insect Collection, CSIRO, Canberra; BMNH British Museum (Natural History), London; DANSW Department of Agriculture, New South Wales, Rydalmere; QM Queensland Museum, Brisbane; SAM South Australian Museum, Adelaide; UC University of Connecticut, Storrs; UQ University of Queensland Insect Collection, Brisbane.

In the following descriptions all measurements are in millimetres, those of the primary type first, of other specimens in parentheses (8 ♂, 10 ♀ of *A. diffinis*; 12 ♂, 11 ♀ of *A. similis*). Length was measured for all specimens, then complete measurements were made of some of the largest and smallest and some intermediates.

The distances from apex of clavus to apex of corium (CC) and from apex of corium to apex of membrane (CM) are measured parallel to the median line of the body.

***Aristaenetus* Distant**

Aristaenetus Distant, 1901, p. 507; Scudder, 1957, p. 154 (in Lethaeini); Slater, 1964, p. 808.

Type species *Rhyparochromus diffinis* Walker, 1872; by monotypy.

REDESCRIPTION

BODY: shining; of moderately large size (length about 6–9).

HEAD: porrect, conically produced but shorter than pronotum, length subequal to or a little greater than width; dorsal surface with fine, short, recumbent hairs, micropunctures and fine striae; base with two iridescent areas composed of overlapping blunt pegs (Fig. 1); ocellular distance less than interocular distance; cephalic trichobothria inserted about level with ocelli and anterior margins of eyes; ventral surface (Fig. 2A) without a deep median trough, but with a shallow anterior trough to about level of mid-line of eyes, not convexly swollen, transversely striate between eyes. Eyes not touching pronotum, with short hairs. Antennae slender, with a recumbent pubescence and sparser erect hairs shorter than width of segments; segment I with length much greater than interocular width, extending for about half its length beyond apex of head; segment IV longer than or subequal to III. Labium extending onto abdomen; segment I reaching or a little exceeding base of head; segment III equal or subequal in length to II; segment IV shortest. Paraclypeus with a distinct ventral carina.

THORAX: Pronotum wider posteriorly than long, strongly narrowed anteriorly where narrower than head; lateral margins concavely excavated, roundly thickened, not at all explanate; a transverse impression present between anterior and posterior lobes, at least at sides; anterior lobe weakly punctate, scarcely to moderately convex, with an anterior collar delimited by a transverse groove, with a long erect seta

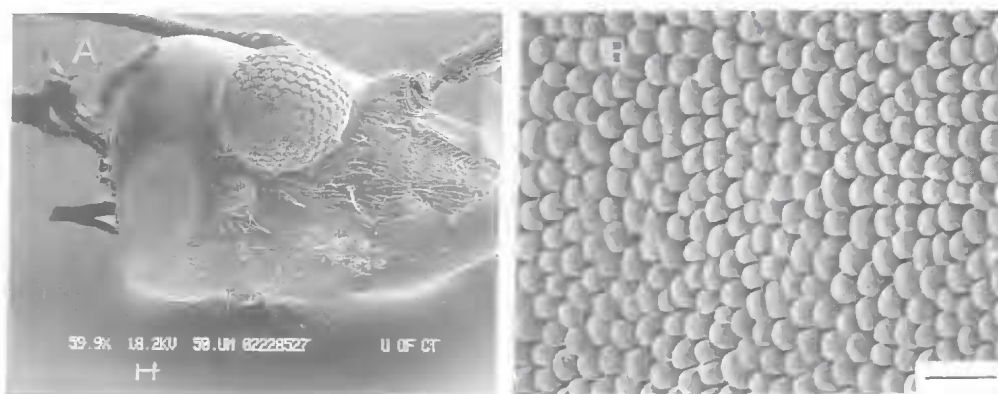


FIG. 1. *Aristaenetus diffinis*. A. Head, dorsolateral view, showing iridescent areas on left, SEM. Scale line = 50 μ m. B. Part of iridescent area, showing pegs (posterior to right), SEM. Scale line = 100 μ m.

near each anterolateral angle; posterior lobe strongly punctate, with a very low median carina, posterolateral angles convexly raised, posterior margin slightly convex. Scutellum finely punctate; considerably longer than claval commissure; with a basal depression and behind this a raised subtriangular area. Clavus with four rows of punctures. Corium with costal margins acutely carinate and narrowly explanate, shallowly concave near basal third, gradually convex in apical two-thirds; with two rows of punctures, separated by a ridge, parallel to claval suture, rest of corium irregularly punctate. Membrane not or only shortly exceeding apex of abdomen, often leaving part of abdominal tergum VII exposed and sometimes all or part of connexiva of tergum VI; with basal cells and a transverse basal crease. Metapleural evaporative area and scent gland peritreme sexually dimorphic; evaporative area reaching more than half way across width of metapleuron, more extensive in δ than in f ; peritreme in δ extremely long, curved back to near posterolateral angle of evaporative area, thence curved forward in reverse comma-shape (Fig. 2C, D), in f variable but much shorter, not or less strongly curved backward (Figs 5–13). Legs slender; fore femur not much stouter than others, with an anteroventral series of long, slender, bristle-like spines and a more distal series of short, thorn-like spines. All tibiae with sharp spines. Hind basitarsus about twice as long as other two tarsomeres together.

ABDOMEN: Submedian trichobothria: on sternum III in triangular series on each side, with middle trichobothrium more posterior than two others; three trichobothria on each side of

sternum IV in transverse linear series. Arrangement of trichobothria of sternum V typically lethaeine, with anterior two trichobothria close together, posterior trichobothrium much closer to posterior margin of sternum than to middle trichobothrium; posterior two trichobothrial areas of sternum VI not contiguous. Spermatheca (Figs 23, 24) with hemispherical bulb; with distal and proximal flanges, with distal part of duct between these widened; narrower proximal part of duct long, without a broadened ring-like region near entry to oviduct. A dorsal sac opening into genital chamber of f . Aedeagus (Figs 18–22) with long, distally coiled or looped vesical seminal duct; sperm reservoir with sleeve moderately to heavily sclerotised, fused with vesical seminal duct distally; arcuate extension variable; wings short and broad; holding sclerites very long, curving around wings proximally and fusing to form a “V” distally.

COMMENTS

Aristaenetus resembles *Neolethaeus* Distant (Ethiopian, Oriental, Australia and Pacific) in the presence of a punctate anterior pronotal collar demarcated by a distinct transverse impression, the clavus having four rows of punctures, the hemelytral membrane having a basal crease and large basal cells, the structure of the male genitalia and, as described by Khan and Woodward (1979), in the structure of the spermatheca and the presence of an accessory dorsal sac in the female. It differs from *Neolethaeus* in the head being about as wide as long (instead of wider than long) and with its ventral surface transversely striate instead of

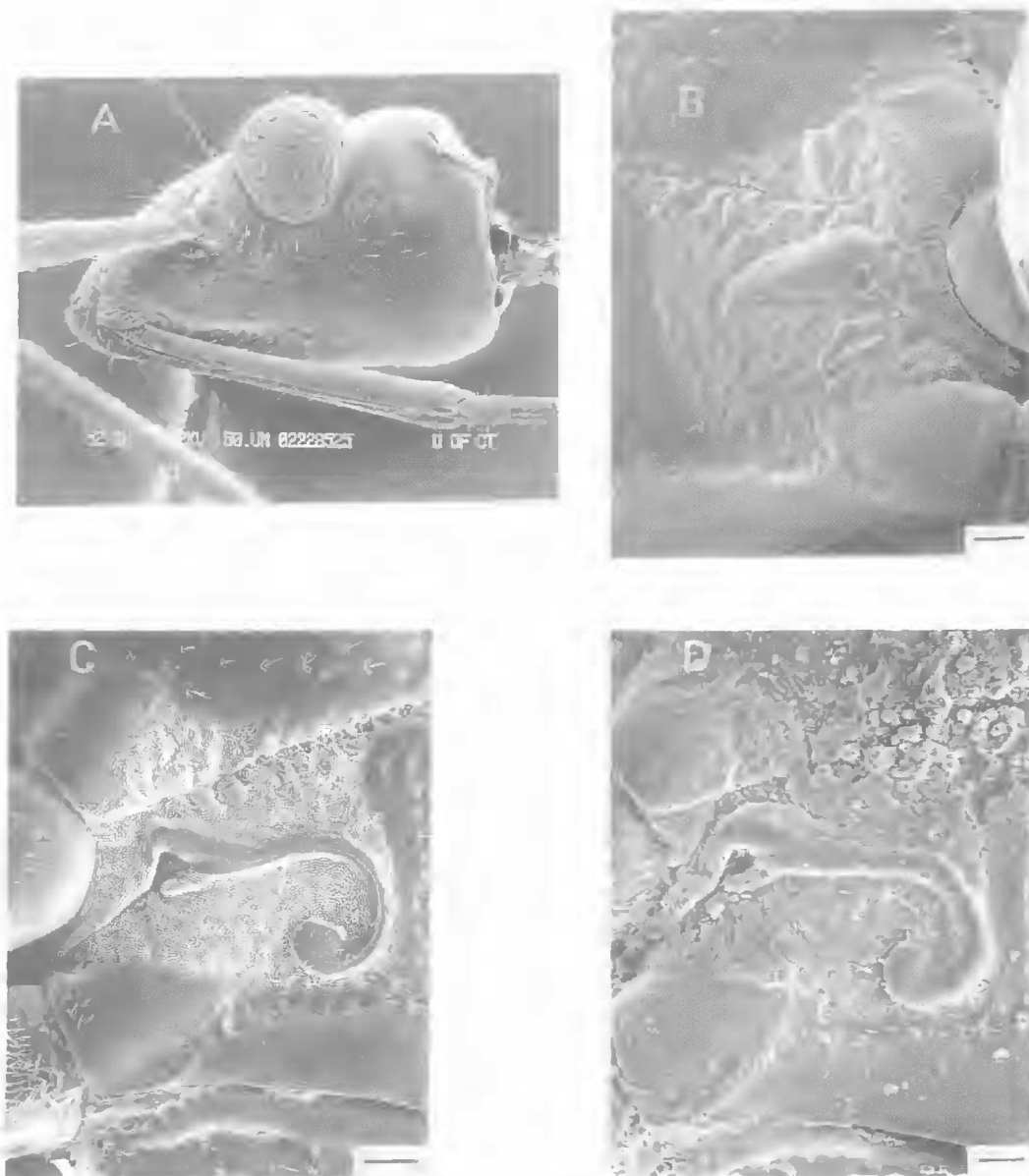


FIG. 2. *Aristaenetus* spp. A. *A. diffinis*, head, ventrolateral view, SEM. Scale line = 50 µm. B. *A. similis*, female evaporative area and scent gland peritreme, SEM. C. *A. diffinis*, male evaporative area and scent gland peritreme, SEM. D. *A. similis*, male evaporative area and scent gland peritreme, SEM. B,C,D, scale line = 100 µm.

punctate, and the lateral pronotal margins being concave and not carinate nor explanate.

A very similar hypertrophy of the male scent gland peritreme occurs in *Neolethaeus cantrelli* Woodward (Australia) and *N. cheesmanae* Woodward (Australia and Papua New Guinea)

(Woodward, 1968), and all 4 species of the neotropical genus *Bubaces* Distant (Brailovsky, 1981). If sexual dimorphism in this structure is a synapomorphy, then the clade so defined establishes a sister-group relationship between Australian and South American taxa; however,

other characters such as the male genitalia conflict with this interpretation. A cladistic analysis of the tribe by the junior author is in progress. This will determine whether synapomorphy or homoplasy more likely explains the observed character state distribution of this feature. Since these structures may play a role in male-male or male-female interactions (Brailovsky, 1981), independent evolution through sexual selection is a possibility.

Sperm reservoir morphology indicates relationships with *Neolethaeus*, *Lophoraghius* Wagner, *Sweetolethaeus* Slater, *Atkinsonianus* Distant, and *Afrodryinus* Scudder. These genera all share the presumed synapomorphy of long, distally joined holding sclerites. Further analysis is needed before sister-groups within this larger group can be determined. *Neolethaeus* is almost certainly composite, and probably contains within it the sister-group of *Aristaenetus*.

Key to the species of *Aristaenetus*

Pronotum (Fig. 3) without a pale median longitudinal stripe on posterior lobe; with lateral margins deeply concave, abruptly diverging to posterolateral angles; anterolateral setae arising from strongly produced tubercles *diffinis* (Walker)

Pronotum (Fig. 4) with a pale median longitudinal stripe on posterior lobe; with lateral margins shallowly concave, diverging gradually to posterolateral angles; anterolateral setae not arising from strongly produced tubercles *similis* sp. nov.

Aristaenetus diffinis (Walker)

(Figs 1, 2A-C, 3, 5-7, 14, 16, 18, 19, 22, 23)

Rhyarochromus diffinis Walker, 1872, pp. 110-111.

Aristaenetus diffinis: Distant, 1901, p. 508; Slater, 1964, p. 808; Scudder, 1967, p. 263.

MATERIAL EXAMINED

Queensland: LECTOTYPE ♀ (selected by Scudder, 1967), Moreton Bay (BMNH); 2 ♂, Moreton I., 2.iv.1966, ex leaf litter, *Banksia*, coll. G.B. Monteith (QM, UQ) (1 ♂, QM, aedeagus inflated and illustrated); 1 ♀, Dunwich, Stradbroke I., 15-16.iv.1967, coll. B. Cantrell (dissected and scanned) (UC); 1 ♀, Ugly Gully, Brisbane, 4.x.1976, at light, coll. P. Samson (UQ); 1 ♂, 8 ♀, 'Camp Milo', Cooloola, 3-13.iii.1970, *Banksia* dom. open forest, to light, coll. E. Dahms (QM); 1 ♀, Caloundra, 11.i.1972, coll. M.B.

Manapatil (UQ); 1 ♀, Karana, Wattle Rd, 13.ii.1977, open forest, coll. A. Slater (QM); 4 ♂, 4 ♀, Telegraph Crossing, Dulhunty R., Cape York Pen., 2-4.vii.1975, under seeding *Callitris*, coll. G.B. Monteith (1 ♂ dissected and scanned) (QM, UC); 1 ♂ Dividing Range, 15 km W. of Captain Billy Creek, Cape York Pen., 11.40S, 142.45E, 4-9.vii.1975, coll. G.B. Monteith (QM).

REDESCRIPTION

COLORATION: Head, anterior lobe of pronotum and underside of thorax shining black; anterior pronotal collar sometimes reddish brown. Eyes reddish brown to dark brown. Ocelli red. Antennal segments I and II yellowish brown to reddish brown, both infuscated distally, I sometimes entirely infuscated reddish brown or black; III reddish brown to black proximally, white to pale brownish yellow distally; IV entirely dark reddish brown to black. Labium pale yellowish brown, segment IV reddish brown, infuscated distally. Posterior lobe of pronotum shining dark reddish brown to black, lacking a median pale stripe and pale sublateral spots on posterior margin; humeral angles sometimes pale. Scutellum, coxae, fore femora, distal part of mid and hind femora, dark brown to black; remainder of legs yellowish brown. Corium and clavus dark reddish brown to black; corium with a subapical, transverse, white or cream patch, usually interrupted in middle by dark vein, with costal margin pale at middle and often at base, usually with a pale patch near middle of disc and another near apex of claval commissure, and often with a pale stripe near claval suture; clavus with a pale stripe near posterior third of scutellum. Membrane, including veins, brown. Venter of abdomen dark reddish brown to black.

BODY: Length 8.5 (♂ 6.3-7.2, ♀ 7.2-8.8); maximum width 2.67 (♂ 2.02-2.51, ♀ 2.14-2.76).

HEAD: Length 1.54 (♂ 1.22-1.43, ♀ 1.26-1.61); width across eyes 1.34 (♂ 1.17-1.34, ♀ 1.20-1.42); interocular space 0.68 (♂ 0.50-0.64, ♀ 0.58-0.68); width of eye 0.33 (♂ 0.30-0.35, ♀ 0.31-0.37). Length of antennal segments I 1.16 (♂ 1.07-1.11, ♀ 1.05-1.18), II 1.70 (♂ 1.60-1.70, ♀ 1.56-1.82), III 1.61 (♂ 1.41-1.52, ♀ 1.33-1.61), IV (♂ 1.45-1.54, ♀ 1.31-1.59). Length of labial segments I 1.57 (♂ 1.36-1.43, ♀ 1.45-1.70), II 1.59 (♂ 1.36-1.41, ♀ 1.47-1.63), III 1.66 (♂ 1.32-1.39, ♀ 1.43-1.68), IV 0.80 (♂ 0.66-0.75, ♀ 0.72-0.84).

THORAX: Pronotum, scutellum, corium and clavus with short, fine, pale, semi-erect hairs,

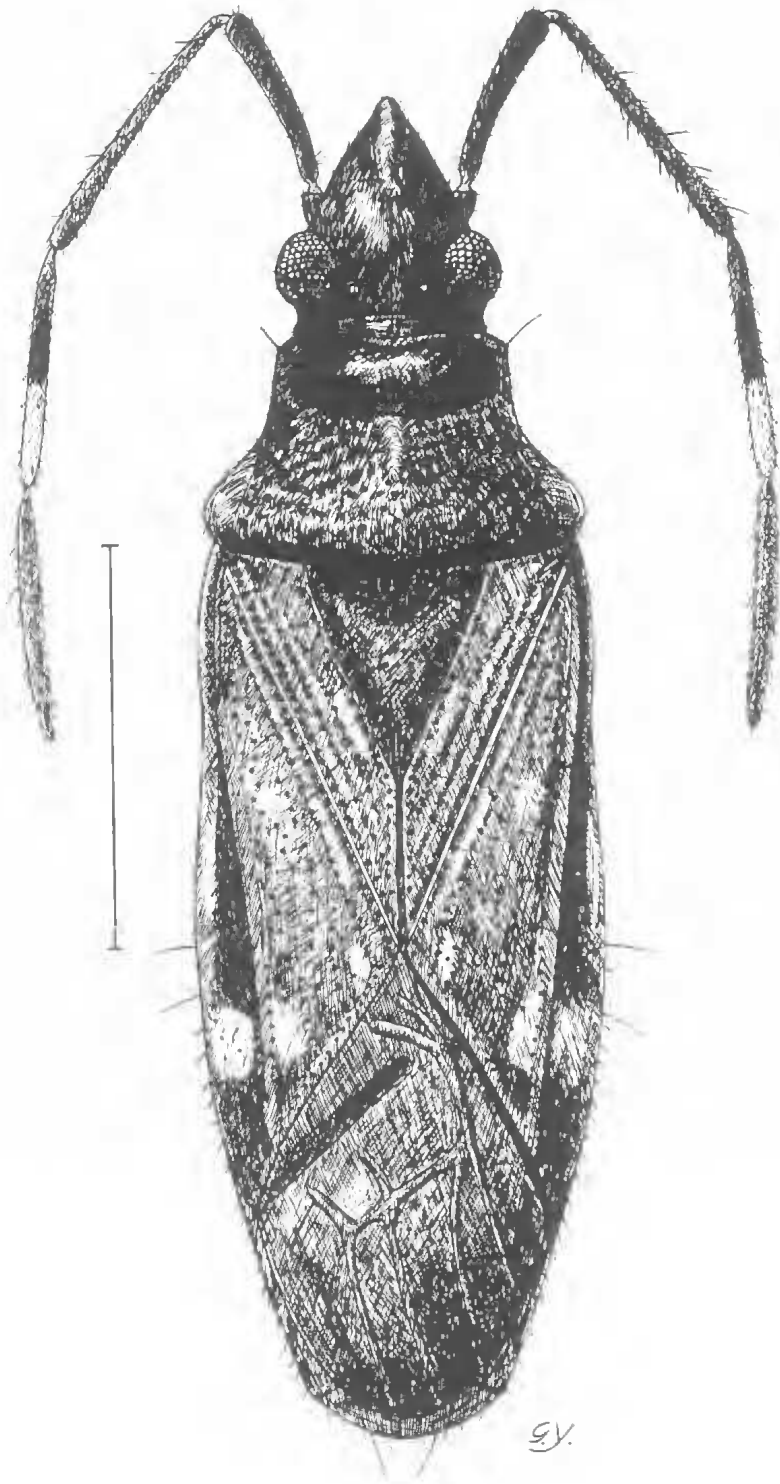


FIG. 3. *Aristaenetus diffinis*, female (Dulhunty R.), dorsal view. Scale line = 3.0 mm.

one from each puncture, longest on and near transverse pronotal impression. Pronotum with lateral margins deeply concavely excavated; transverse impression between anterior and posterior lobes well defined, deepest laterally, anterior lobe with long lateral setae each arising from a strongly protuberant tubercle, with calli confluent, smooth except for scattered micropunctures most obvious in shallow posterior fovea; posterior width of pronotum 2.51 (δ 1.90–2.37, η 2.09–2.60), median length 1.70 (δ 1.39–1.58, η 1.48–2.09). Scutellum: anterior width 1.30 (δ 0.87–1.23, η 0.94–1.50), median length 1.50 (δ 1.10–1.34, η 1.12–1.56). Length of claval commissure 0.88 (δ 0.77–0.92, η 0.63–0.98); CC 1.28 (δ 0.91–1.44, η 1.17–1.56); CM 1.36 (δ 0.65–1.28, η 0.69–1.35); corium 4.28 (δ 3.24–3.87, η 3.46–4.45). Scent gland peritreme of δ sinuously curved forward toward anterolateral angle of metapleural evaporative area before curving back (Fig. 2C), short peritreme of η not or only slightly curved (Figs 5–7). Fore coxa with one strong bristle, mid and hind coxae with 3 strong bristles on exteroventral margin. Fore femur with an anteroventral row of 5 or 6 long, fine spines and 3 much shorter, thorn-like ventral spines near distal end, the most proximal longest.

ABDOMEN: Ventral surface with a covering of fine, decumbent hairs and longer, semi-erect hairs. Male: tergum VII (Fig. 14) with lateral margins shallowly concave, posterior margin narrow, strongly convex; paramere (Fig. 16) with apex narrow, curved, posterior lobe rounded; vesical seminal duct of aedeagus (Fig. 22) very long, narrow, not heavily sclerotised, with several loops. Female: spermatheca (Fig. 23) with duct extremely long; proximal flange sinuously curved, strongly oblique.

***Aristaenetus similis* sp. nov.**

(Figs 2B,D, 4, 8–13, 15, 17, 20, 21, 24)

MATERIAL EXAMINED

Queensland: HOLOTYPE δ , T.9437, Fraser Island, nr VA288, E. of Lake Bowarrady, 2–3.xii.1975, at light, coll. A. Slater and G. Thompson (QM); 1 PARATYPE δ , T.9438, Fraser Island, Yidney Scrub, nr VB52, 3–4.xii.1975, in leaf litter, coll. G. Thompson and A. Slater (QM); 2 η Paratypes, T.9439, 9440, Brisbane, 20.v.1964, coll. H.A. Rose (UQ); 2 δ Paratypes, same data (UC); 1 Paratype η , Brisbane, 15.iii.1942, coll. J.S. Ralston (UQ); 1 Paratype δ , xii.1954, coll. F.C. Sweeney (UQ); 1 Paratype η , T.9441 St. Lucia,

Brisbane, 22–24.i.1975, coll. G. Thompson (QM); 1 δ , 1 η Paratypes, T.9442, 9443, same data except 24.vi.1975 (QM); 1 Paratype δ , same data except 23.vi.1975 (UC); 2 δ , 3 η Paratypes, T.9444–9448, Mt Coot-tha, Brisbane, 13–20.iii.1971, ex leaf litter, coll. G.B. Monteith (QM); 1 Paratype δ , same data (UC); 2 δ , 2 η Paratypes, T.9449–9452, Mt Coot-tha, Brisbane, 10.i.1975, ex leaf litter beneath eucalypts, coll. G.B. Monteith (QM); 2 η Paratypes, T.9453, 9454, Mt Coot-tha, Brisbane, 17.x.1976, coll. A. Slater (QM); 1 Paratype δ , Ashgrove, Brisbane, 16.iii.1947, coll. J. Rosser (UQ); 1 Paratype η , T.9455, Moggill, Brisbane, 1.ix.1963, coll. G.B. Monteith (QM); 1 Paratype δ , T.9456, Moggill, Brisbane, 1.x.1955, coll. T.E. Woodward (QM); 1 Paratype η , Manly, Brisbane, iv.1954, coll. G. Hooper (UQ); 1 Paratype η , T.9457, Gold Creek Rd. Brookfield, Brisbane, 16.ii.1977, wet forest, coll. A. Postle and G. Thompson (QM); 1 Paratype δ , Mt Nebo, 4.x.1954, leaf mould, coll. A.J. Peberdy (UQ); 1 Paratype η , T.9458, Cooloola, nr Fresh Water Lake, 3–13.iii.1970, rain forest, to light, coll. E. Dahms (QM); 2 δ , 3 η Paratypes, T.9459–9463, Imbil State Forest, 3.iv.1969, coll. B. Cantrell (QM); 1 Paratype η , T.9464, Kenilworth State Forest, 1.iv.1969, coll. B. Cantrell (QM); 1 Paratype η , T.9465, Amamoor, via Gympie, 28.ii.1976, coll. G.B. Monteith (QM); 1 Paratype η , Lacey's Creek, Mission Beach, 21.iv.1970, coll. G.B. Monteith (dissected and scanned) (UC), 1 Paratype δ , 3 km W. of Mission Beach, 18.iv.1969, coll. I.F.B. Common and M.S. Upton (ANIC); 1 δ , 1 η Paratypes, T.9466, 9467, Palmerston Nat. Pk. via Innisfail, 23–24.iv.1968, coll. B. Cantrell (QM); 1 Paratype δ , Tully, iii.1955, coll. A.J. Cowan (UQ). New South Wales: 1 Paratype η , Lennox Head, N. of Ballina, hind dunes, 10.iii.1981, coll. M.J. Fletcher and G.R. Brown; 1 Paratype δ , Victoria Pk, Alstonville, 15 km E. of Lismore, 9.iii.1981, coll. M.J. Fletcher and G.R. Brown; 1 Paratype δ , Beecroft [Sydney], 19.x.1966, at MV light, coll. O.M. Williams (all DANSW).

COLORATION: As for *A. diffinis* except for the following. Posterior lobe of pronotum with a pale median longitudinal stripe, broadest and best defined near posterior margin, and with a pair of pale sublateral spots on posterior margin. Veins of hemelytral membrane usually pale.

BODY: Length 7.0 (δ 6.0–7.0, η 6.8–8.3); maximum width 2.19 (δ 1.76–2.23, η 2.07–2.97).

HEAD: Length 1.30 (δ 1.06–1.31, η 1.91–1.28); width across eyes 1.16 (δ 1.03–1.18, η 1.08–1.28); interocular space 0.58 (δ 0.51–0.60, η 0.52–0.66); width of eye 0.29 (δ 0.26–0.31, η 0.27–0.31). Length of antennal segments I 1.00 (δ 0.81–1.04, η 0.93–1.13), II 1.50 (δ 1.37–1.70, η 1.34–1.62), III 1.25 (δ 1.22–1.46, η 1.22–1.45), IV 1.33 (δ 1.30–1.52, η 1.22–1.48). Length of labial segments I 1.30 (δ 1.11–1.30, η 1.27–

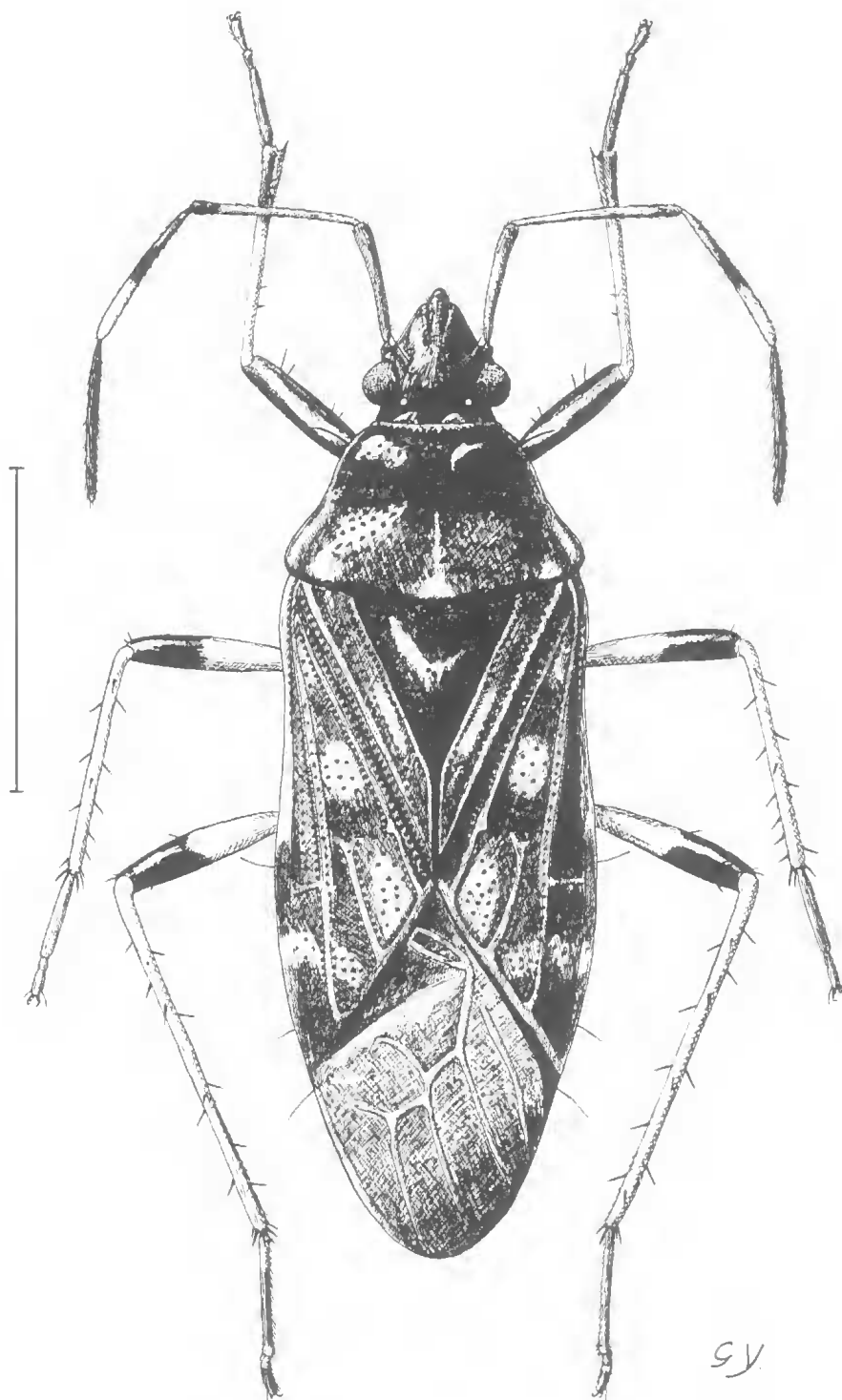
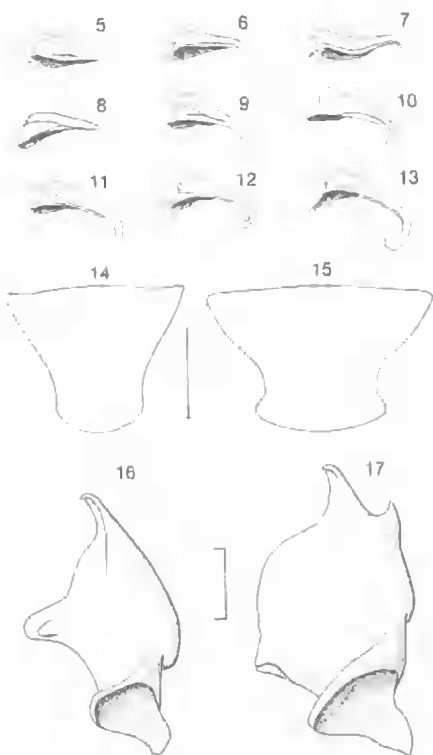


FIG. 4. *Aristaenetus similis*, paratype female (Cooloola), dorsal view. Scale line = 3.0 mm.



FIGS 5-13. Female scent gland peritremes, *Aristaenetus* spp. 5-7 - *diffinis*; 8-13 - *similis*.

FIGS 14, 15. Male abdominal tergum VII, *Aristaenetus* spp. 14 - *diffinis*; 15 - *similis*. Figs 5-15, scale line = 0.5 mm.

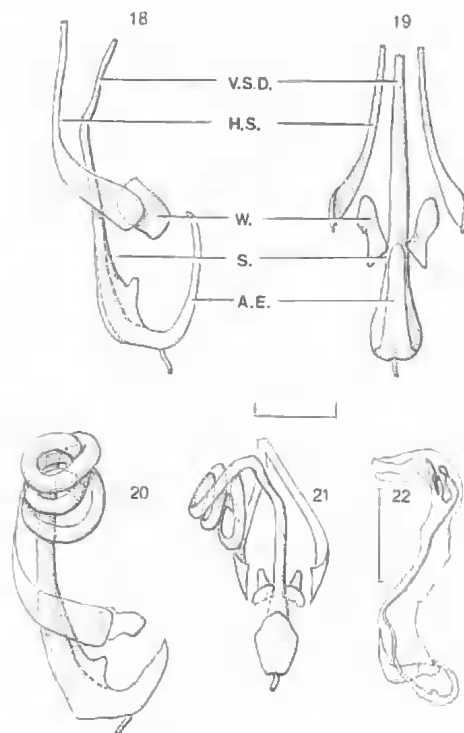
FIGS 16, 17. Male: left paramere, inner view, *Aristaenetus* spp. 16 - *diffinis*; 17 - *similis*. Scale line = 0.1 mm.

1.49), II 1.25 (δ 1.09-1.25, η 1.19-1.42), III 1.22 (δ 1.06-1.22, η 1.11-1.49), IV 0.65 (δ 0.57-0.65, η 0.63-0.76).

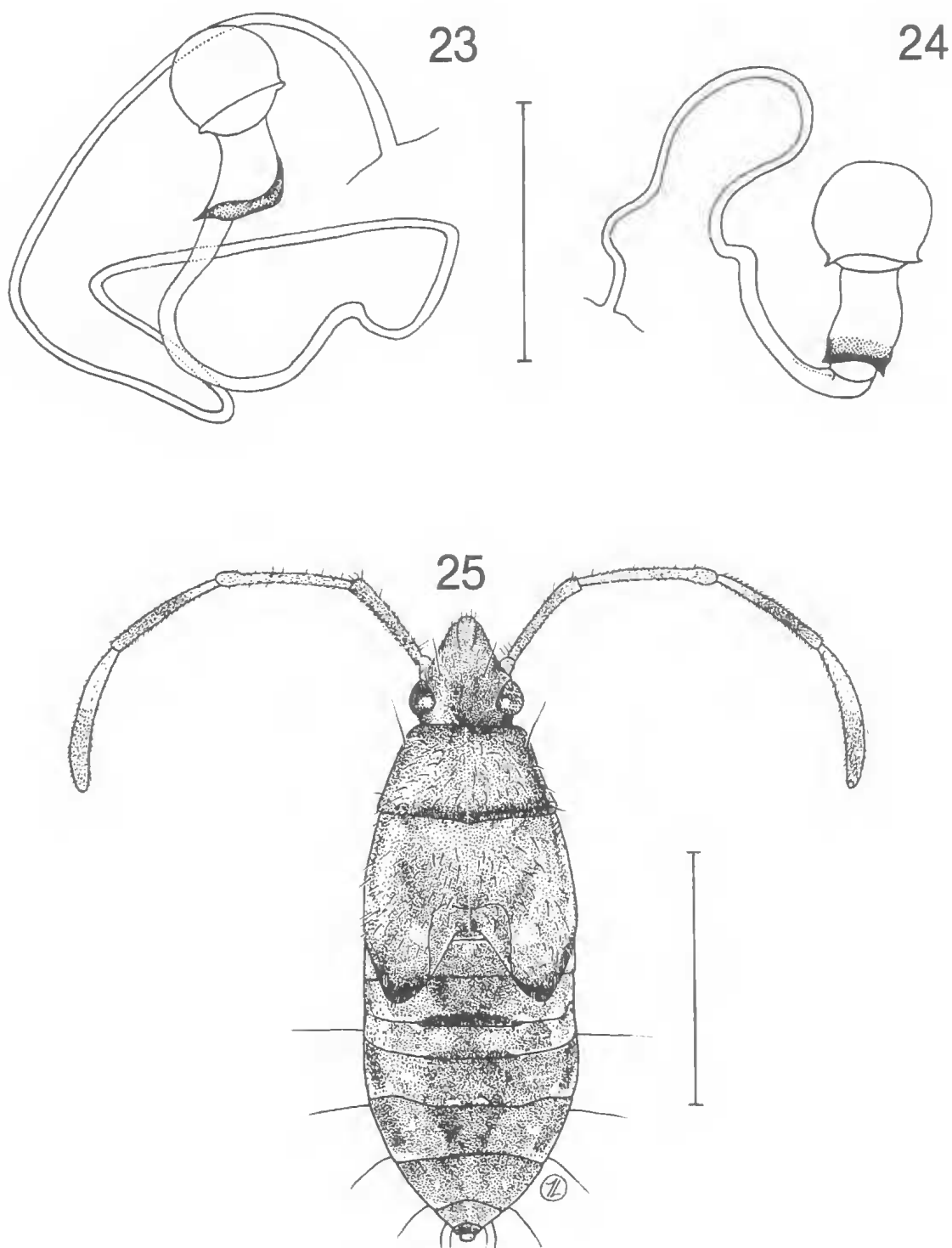
THORAX: Dorsal hairs all very short and inconspicuous. Pronotum (Fig. 4) with lateral margins more shallowly excavated than in *A. diffinis* (Fig. 3); transverse impression between lobes shallower than in *A. diffinis* and restricted to lateral regions; anterior lobe with lateral setae not arising from strongly protuberant tubercles, with calli separated by band of fine punctures extending forward from shallow posterior fovea, surface of calli more obviously micropunctate than in *A. diffinis*; posterior width of pronotum 2.00 (δ 1.65-2.00, η 1.83-2.69), median length 1.44 (δ 1.26-1.44, η 1.33-1.80). Scutellum: anterior width 1.12 (δ 0.82-1.12, η 0.96-1.46), median length 1.26 (δ 1.02-1.27, η 1.20-1.62).

Length of claval commissure 0.76 (δ 0.64-0.85, η 0.71-0.95); CC 1.30 (δ 0.88-1.38, η 1.26-1.53); CM 1.50 (δ 1.05-1.50, η 1.00-1.65); corium 3.55 (δ 3.18-4.10, η 3.63-4.35). Scent gland peritreme of δ curved backward more abruptly than in *A. diffinis*, not sinuously curved forward (Fig. 2D), shorter peritreme of η extremely varied in length and degree of curvature (Figs 8-13). Spination of coxae and fore femur as in *A. diffinis*.

ABDOMEN: Ventral hairs shorter than in *A. diffinis*. Male: tergum VII (Fig. 15) with lateral margins strongly concavely excavated, posterior margin broadly convex, subtruncate; paramere (Fig. 17) broadly expanded, apex narrow, posterior lobe with a more pointed projection; vesical seminal duct (Figs 20, 21) wider and more heavily sclerotised than in *A. diffinis*, with



FIGS 18-22. Male: aedeagal structures, *Aristaenetus* spp. 18, 19 - *diffinis*, sperm reservoir, 18 - lateral view, 19 - dorsal view; 20, 21 - *similis*, sperm reservoir and vesical seminal duct; 20 - lateral view, 21 - dorsal view; 22 - *diffinis*, aedeagus, lateral view, with vesica expanded. A.E. arcuate extension; H.S. holding sclerite; S. sleeve; V.S.D. vesical seminal duct; W. wing. Scale lines: 18-21 = 0.1 mm; 22 = 0.5 mm.



FIGS 23, 24. Spermathecae, *Aristaenetus* spp. 23 - *diffinis*; 24 - *similis*. Scale line = 0.5 mm.
 FIGS 25. *Aristaenetus similis*, 5th instar nymph, dorsal view. Scale line = 2.0 mm.

about 3 coils. Female: spermatheca (Fig. 24) with duct ca $\frac{1}{2}$ as long as in *A. diffinis* (Fig. 23); proximal flange annular, not oblique.

COMMENTS

In addition to the characters given in the key, *A. similis* differs from *A. diffinis* in the shorter labium; the pronotum having the transverse impression between the anterior and posterior lobes shallower and not extending so far toward the mid-line, and the calli separated by punctures and more distinctly micropunctate; the shorter body hairs; the less sinuously curved scent gland peritreme of the male; the structure of the paramere; the shorter and much thicker vesical seminal duct; the broad apex of abdominal tergum VII of the male; and the shorter spermathecal duct with the proximal flange not curved nor oblique.

NYMPHS OF *A. Similis*

MATERIAL EXAMINED

Queensland: 4 instar V, 2 instar IV, Mt Cool-lha, Brisbane, 13-20.III.1971, ex leaf litter (in 80% ethanol), associated with 2 ♂ and 3 ♀ paratypes, coll. G.B. Monteith (QM).

INSTAR V (Fig. 25)

COLORATION: Dark reddish brown. Antennae with segment I, ca distal $\frac{1}{3}$ of III and more than distal $\frac{1}{2}$ of IV infuscated reddish brown; proximal part of IV off-white. Labium yellowish brown, segment IV infuscated. The following creamish yellow: lateral margins of pronotum and of fore wing pads; patches near inner margins of wing pads, laterally on abdominal terga, sublaterally on terga III—V, anteromedially on tergum II, submedian pair on terga IV and V; basitarsi and tibiae; extreme distal ends of femora; abdominal sternum II anterolaterally. Coxae reddish cream with brown markings; fore trochanters brown; trochanters and proximal ends of femora of mid and hind legs off-white; extreme distal ends of femora creamish yellow to light red; all femora mainly brown; tarsomeres II light brown.

Body: Length 4.62–5.54; maximum width 1.96–2.06.

Head: Porrect, produced; length 1.04–1.27; width 1.00–1.08; interocular space 0.57–0.59; width of eye 0.22–0.25; a little convex across vertex; dorsal surface with fine, pale, suberect hairs; anteclypeus reaching to ca $\frac{1}{2}$ way along antennal segment I. Epicranial stem extremely

short, usually covered by pronotum; arms sinuate. Eyes remote from anterior pronotal margin. Antennal segments linear, I thickened and II slightly thickened at distal end, IV slightly curved; length I 0.84–0.92, II 1.22–1.31, III 1.12–1.16, IV 1.27–1.31. Labium clongate, reaching well onto abdominal sternum IV, segment I reaching base of head; length of segments I 1.08–1.18, II 1.08–1.18, III 1.02–1.08, IV 0.59–0.65.

THORAX: Notula and wing pads with line erect hairs longer than those of head. Pronotum slightly convex in anterior half; subquadrate, with anterior and lateral margins straight, posterior margin slightly convex in middle; lateral margins narrowly explanate; with a pair of anterolateral setae inserted about level with lateral margins of eyes; median length 0.82–0.92, posterior width 1.53–1.63. Mesothoracic wing pads extending ca $\frac{1}{4}$ – $\frac{1}{2}$ way along abdominal tergum III; length 1.53–1.71; lateral margins more widely explanate than those of pronotum. Coxal, tibial, and fore femoral spination similar to that of adult.

ABDOMEN: Elliptical. Scent gland sclerotisations straight between openings; that of terga III–IV slightly wider than IV–V; V–VI ca $\frac{1}{10}$ as wide as III–IV.

INSTAR IV

Similar in coloration and morphology to instar V except:

Body: Length 4.43–4.52; width 1.76–1.80.

Head: Length 0.92–1.08; width 0.88–0.92; interocular space 0.53–0.55; width of eye 0.18–0.19. Length of antennal segments I 0.75–0.78, II 1.04–1.08, III 0.92–0.94, IV 1.14–1.16. Length of labial segments I 0.98–1.02, II 0.90–0.92, III 0.88, IV 0.59.

THORAX: Lateral margins of pronotum and mesothoracic wing pads reaching to base of abdomen; length 0.84–0.88.

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two dorsal illustrations of the adults and Mr T. Low that of the nymph. Mr G. Thompson inked in the drawings of the spermathecae, evaporative areas and scent gland peritremes and assisted with the assembling of illustrations. Dr J.A. Slater commented on the manuscript. Jim Romanow and Dr Alan Wachtel assisted with the SEM.

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